**ANSWERS: Describing and Explaining shapes of molecules**

**1)** Available in April 2014

**2)** The central atom in SO2 has three regions of electron density/electron clouds around it. The regions of electrons are arranged as far apart as possible from each other (in order to minimise repulsion) making a trigonal planar shape. This gives a bond angle of 120°. Only two of these regions of electrons are bonding and one is non-bonding so the shape of the molecule is **V-shaped (bent).**

The central atom of H2CO, has three regions of electron density around it. The regions of electrons making a trigonal planar shape, giving a bond angle of 120°. All three of these regions of electrons are bonding so the arrangement of the bonds/molecular shape is **trigonal planar**.

**3)** The central atom in **SO2** has three regions of electron density (sets of electrons) around it. Two of these are bonding and one is non bonding. The non bonding pair contributes to the shape but is not considered part of the shape. The regions of electron density are arranged as far apart as possible from each other in a trigonal planar position. This is why the bond angle is 120o.

*(The angle of 120 o is written theNCEA Sample Exam 2012 Assessment Schedule. I disagree with this value, given that there is 1 lone pair around the central atom, I would suggest as given in the Sample answers that this molecule has 3 regions of electron density around the central atom, which repel each other with maximum repulsion resulting in the molecule having a bent or v-shape. There are 2 bonded pairs and 1 lone pair around the central atom, with a bond angle of less than 120 o due to repulsion caused by the 1 lone pair of electrons, so I would suggest that the bond angle is 118 o, however, don’t panic 120 o will certainly be accepted as correct.)*

The central atom in **H2S** has four regions of electron density around it. Two of these are bonding and two are non bonding. These four regions repel each other as far apart as possible. The regions of electron density are arranged as far apart as possible from each other in a tetrahedral position. This is why the bond angle is 109o.

*(The angle of 109 o is written theNCEA Sample Exam 2012 Assessment Schedule. I disagree with this value, given that there are 2 lone pairs and 2 bonded pairs around the central atom, I would suggest that this molecule has 4 regions of electron density around the central atom which repel each other with maximum repulsion resulting in a bent or v-shape. As there are 2 bonded pairs and 2 lone pairs around the central atom, with a bond angle of less than 109 o caused by repulsion of the 2 lone pairs of electrons, so I would suggest that the bond angle is 104 - 105 o (water is another similar example)*

**4)** The shape of a molecule is determined by the regions of negative charge surrounding the central atom and the number of bonding atoms.

**NOCl**

The bond angle is approximately 120°.

There are three regions of negative charge around the central N atom which repel to give maximum separation. There are two bonding electrons / negative regions to the N atom and one lone pair of electrons, therefore the overall shape is bent.

*I would suggest that the bond angle is 118 o*

**H2S**

The bond angle is approximately 109°.

There are four regions of negative charge around the central S atom which repel to give maximum separation. There are two bonding electrons / negative regions to the S atom and two lone pairs of electrons, therefore the overall shape is bent.

*I would suggest that the bond angle is 104 o*

**5)**

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|  | There are 4 electron repulsions around the central O atom which leads to a tetrahedral shape. This forms a bond angle of 109o.  *I would suggest a bent or v-shape due to 2 bonding pairs and 2 lone pairs so a bond angle of 104 o* |

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|  |  | There are 3 electron repulsions around the central O atom which leads to a trigonal planar shape. This forms a bond angle of 120o.  *I would suggest a bent or v-shape due to 2 bonding pairs and 1 lone pairs so a bond angle of 118 o* |

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